Fourth Monthly Report of the MI BPM Upgrade
October, 2005
wbs item 1.1.3.2 of the Run 2 Luminosity Upgrade Project
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November 10, 2005

**Project Definition:**

The MI BPM Upgrade will replace the current BPM electronics and the data acquisition system used to transfer information between the BPMs and the Accelerator Controls Systems. As part of the project, the software used to read out, transfer, store, and analyze the BPM data will be upgraded. The goal of the project is to provide a BPM system based on modern hardware and software that gives the higher resolution and expanded functionality necessary to efficiently understand and operate the Main Injector now and for the foreseeable future including the needs for Run 2 and NUMI. Deliverables of the project include all relevant documentation, manuals, user's guides and any other written records necessary for maintaining the system.

**Project Manager's Summary:**

Progress was made in October on requirements, design, testing, purchases and implementation of many components of the system. A target of January 16, 2006 was chosen to have a final hardware/functional software" system installed, tested, and operating as replacement for at least one MI BPM "house".

Many of the combiner boards that have been delivered were installed whenever opportunities arose. So far 63 boards have been installed in the tunnel. The procedure used to test and install new boards (in their boxes) has been worked out and the process used to remove the old boards + boxes, get them checked for radiation activation, safely transport them to the Feynman Computing Center, and then remove the old boards and install new combiner boards has also been tested. The plan is to install boards as quickly as possible and to push to get the remaining 124 boards delivered to the lab and ready for installation.

The transition board and timing board designs were reviewed on October 12, 2005. Recommendations from the review are available in beams-doc-2002. The timing board is ready for final fabrication and steps have been taken to produce the PC cards and order the components needed to build the required boards. A 2-channel transition board prototype has been used to measure the performance of the design and modifications have been made and tested as a result of this testing. The board layout is essentially complete and will be reviewed in early November. The first 8-channel prototypes will be assembled soon after.

The crates, backplanes, control systems and cables are all being specified, designed, and ordered. The goal is to procure all equipment as quickly as possible to allow for rapid

installation. No unnecessary delays should be incurred while waiting for equipment to be specified or ordered or delivered.

A plan for the front-end software has been produced and can be found in beams-doc-1985. Work is proceeding on working through all issues having to do with providing closed orbit and turn by turn measurements in both the 2.5 MHz and 53 MHz bands. Porting effort for device drivers and other applications for the MVME 5500 front-end is proceeding. Performance measurements of the readout capability of the Echotek to front-end have been made and show that the system meets and in fact exceeds the requirement.

Planning for the final installation of the 7 production systems in the MI service buildings requires some detailed information about rack space, future needs for the upgraded BPM and BLM systems, cable runs, control signals, Ethernet connections, etc. Marv Olson and others have examined and documented in beams-doc-1822 the details of installation options. This will be most valuable as we move forward to test and install systems.

During October the requirements document for the MI BPM upgrade was finalized and released as beams-doc-1986-v7. This was a major accomplishment and was the result of much discussion among people involved in the operation of the accelerator and the design of the upgrade.

**Resources Used in October 2005:**

The total time worked on the project in calendar October 2005 from the Computing Division was 4.7 FTE-months with 14 people contributing. The time worked from the Accelerator Division was 3.5 FTE-months with 10 people contributing. The total time worked from both Divisions was 8.2 FTE-months. The following table gives the estimated or reported effort for both divisions (in FTE-months) since July, 2005.

| Month | AD Effort | CD Effort | Total Effort |
|---|---|---|---|
| July, 2005 | 2.1 | 2.4 | 4.5 |
| August, 2005 | 1.4 | 2.7 | 4.1 |
| September, 2005 | 2.8 | 3.7 | 6.5 |
| October, 2005 | 3.5 | 4.7 | 8.2 |
| SUM (through Oct, 2005) | 9.8 | 13.5 | 23.3 |

The effort listed here is time worked and does not include vacation, sick leave, holidays, etc. It should be noted here that the effort increased in October and this is encouraging given the large amount of work required to design, fabricate, install and commission this system.

**Purchase requisitions/procard obligations through October, 2005:**

| Name | Req #/PO/Fermi | PO Date | Item | QTY | Estim. Cost |
|---|---|---|---|---|---|
| MIBPM Timing Fanout Generator module (Includes 11 TFG for MIBPM & 4 extra for MI 8) | PRN70444 | 10/21/2005 | PC BOARDS | | $1,292.50 |
| | PRN70446 | 10/21/2005 | | | $2,499.20 |
| | PRN70451 | 10/21/2005 | | | $1,729.84 |
| | PRN70452 | 10/21/2005 | | | $1,273.75 |
| | PRN70458 | 10/21/2005 | | | $99.86 |
| | PRN70461 | 10/21/2005 | | | $601.42 |
| | PRN70506 | 10/24/2005 | | | $766.81 |
| | PRN70512 | 10/24/2005 | | | $1,390.80 |
| | PRN69734 | 10/4/2005 | | | $25.00 |
| | PRN69772 | 10/5/2005 | | | $19.00 |
| | PRN70625 | 10/25/2005 | | | $819.22 |
| | PRN70635 | 10/26/2005 | | | $1,003.20 |
| | PRN70638 | 10/26/2005 | | | $1,451.44 |
| | PRN70641 | 10/26/2005 | | | $1,871.20 |
| | PRN70646 | 10/26/2005 | | | $1,358.00 |
| | PRN70656 | 10/26/2005 | | | $2,330.00 |
| | PRN70660 | 10/26/2005 | | | $2,087.50 |
| | PRN70746 | 10/28/2005 | | | $602.80 |
| | PRN70801 | 10/31/2005 | | | $354.00 |
| | PRN70839 | 10/31/2005 | | | |
| MIBPM Digital Crates | PO566244/Req182408-183233 | 10/31/2005 | | 16 | $67,292.00 |
| MIBPM MVME | PO566124/Req182982 | 10/20/2005 | MVME5500 | 11 | $33,165.00 |
| MIBPM Analog Power Supply - Acopian | PO566158 | 10/24/2005 | | 11 | $16,687.00 |
| | PO566311/Req183205 | 11/4/2005 | Lemo connector | 800 | $4,592.00 |
| | | | **Monthly cost** | | **$143,311.54** |

**Milestones:**

| | | |
|---|---|---|
| 1.1.3.2.1.2 | MI BPM: Review (Milestone) | 7/25/2005 |
| 1.1.3.2.4.2 | All Combiner boxes available | 10/25/2005 |
| 1.1.3.2.3.1.3.5 | Transition module PO issued | 1/10/2006 |
| 1.1.3.2.6 | MI BPM system complete | 8/15/2006 |

The October 25 milestone for combiner boards was missed due to fabrication problems at the company, GAMA Electronics. Steps are being taken to recover all unfinished product and to complete the 225 boards at Fermilab if necessary.

**Meetings held, Reports Given:**

Meetings were held in October on the following dates:

Project Meetings: October 4, 11, 18, 25.

Transition and Timing Board Review: October 12

**Documents:**

The following documents were written and added to the Accelerator Division Document Database during October, 2005.

1951-v1 Monthly Report of the MI BPM Upgrade Project Steve Wolbers *et. al.* 31 Oct 2005

1996-v5 MI BPM Configurations for Operational States David P Capista 31 Oct 2005

1968-v3 Measurements on the MI BPM Transitionboard Manfred Wendt 28 Oct 2005

2007-v1 Extra Wide Aperture BPM Test Stand Measurement Results James A. Fitzgerald 28 Oct 2005

1526-v3 MI BPM Meeting Notes and Minutes Steve Wolbers 26 Oct 2005

1786-v7 Requirements for the Main Injector BPM upgrade Alberto Marchionni *et. al.* 24 Oct 2005

2002-v1 MIBPM Electronics review Report Vince Pavlicek *et. al.* 24 Oct 2005

1998-v1 Summary of MI BPM requirements Alberto Marchionni *et. al.* 24 Oct 2005

1822-v2 MI Service Building Survey (BPM electronics space) Marv Olson 13 Oct 2005

1985-v1 MIBPM front-end software release schedule Luciano Piccoli 11 Oct 2005

1978-v2 Memo on Preliminary Values for MI BPM Polynomial Coefficients Bob Webber 03 Oct 2005

**Subproject Leader Reports:**

**Rob Kutschke: Validation**

I am waiting for the first prototype equipment to be deployed. I have discussed with various people the measurements that should be performed once the equipment is available.